

SDO and STEREO observations of prominence dynamics during a series of eight homologous flares

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Abstract

Homologous flares are eruptive events that occur repetitively in the same active region, with similar structure and morphology. A series of at least eight homologous flares occurred in active region NOAA 11237 over 16 – 17 June 2011. A filament is rooted in the active region with an overlying coronal cavity. The active region appears on the southeast solar limb as seen from SDO/AIA, and on the disk as viewed from STEREO-B/EUVI; the dual perspective allows us to study in detail behavior of prominence/filament material entrained in the magnetic field of the repeatedly-erupting system. Each of the eruptions was mainly confined, with active-region prominence material being ejected from the core of the erupting region onto outer-lobe loops of the active region. The eruption series repeatedly disrupted material of a quiet-Sun extension of the prominence, and that material became suspended at progressively higher heights above the surface. Two final eruptions from the core region destabilized the field holding that material, instigating a coronal mass ejection (CME).

Observations and Data Analysis

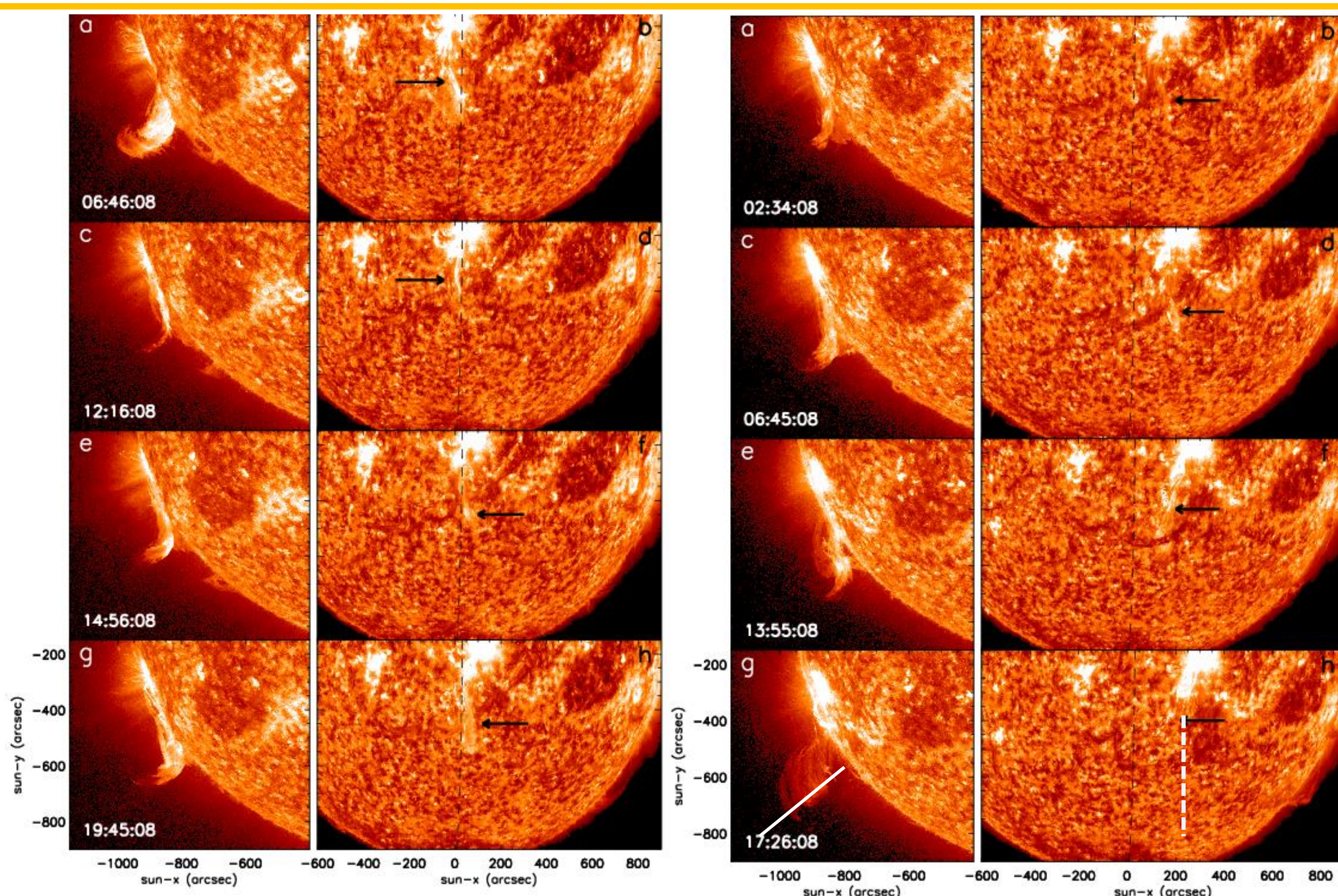


Fig.1. Homologous flares observed on 16 June 2011: (left) AIA 304 Å intensity images; (right) corresponding EUVI-B 304 Å images. On the corresponding EUVI-B 304 Å images. Annotated EUVI image, the dashed line shows the position of the prominence, and the arrow points the position of the flare on the disk images. Y-axis is the same in both AIA and EUVI images.

Fig.2. Homologous flares observed on 17 June 2011: (left) AIA 304 Å intensity images; (right) corresponding EUVI-B 304 Å images. Annotated EUVI image, the dashed line shows the position of the prominence, and the arrow points the position of the flare on the disk images. Y-axis is the same in both AIA and EUVI images.

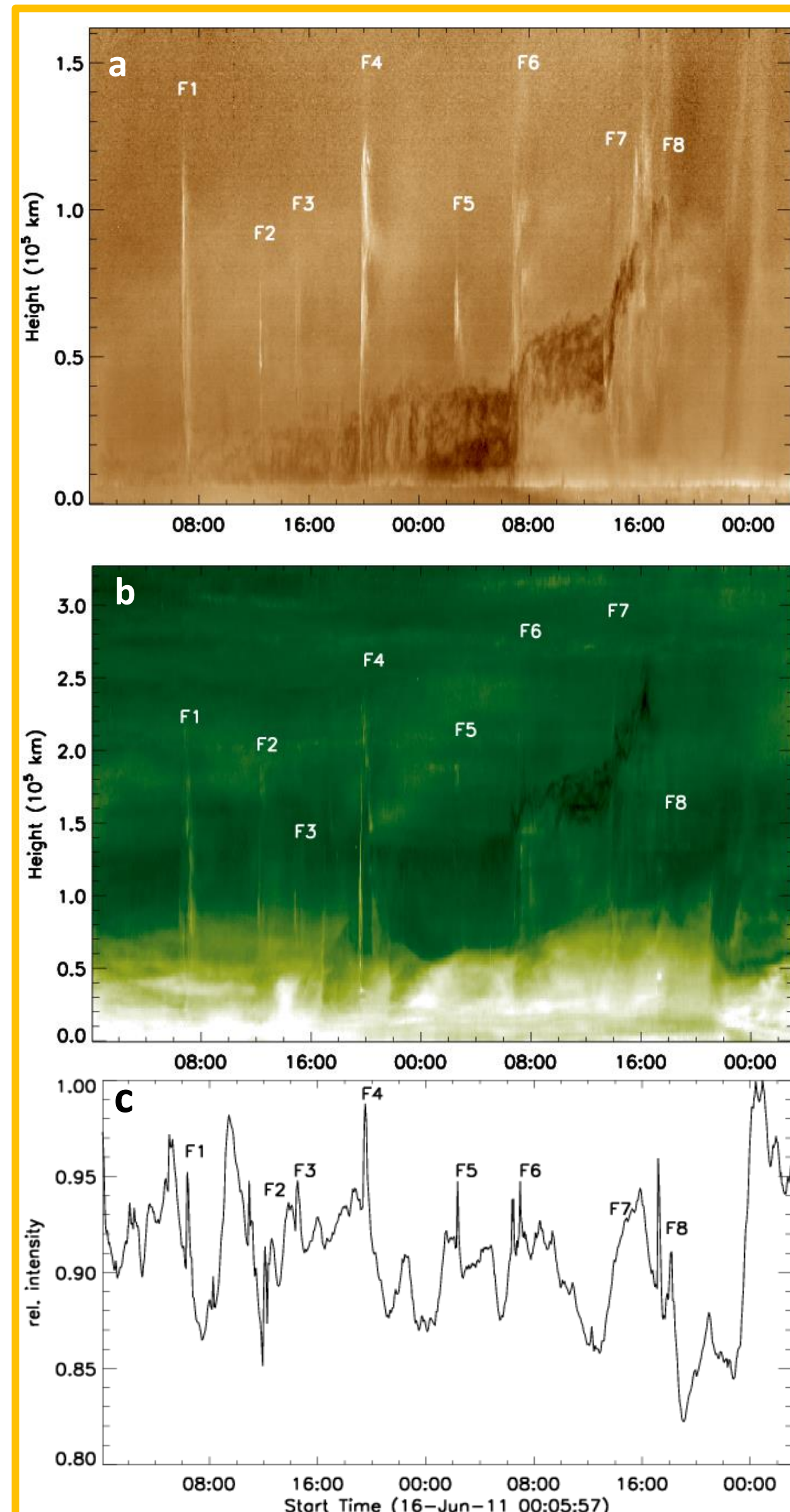


Fig.3a. AIA 193 Å intensity time-series along the diagonal line in Fig. 2g. It shows the prominence trajectory as a function of time over 16-18 June 2011. F1-F8 highlights the position of eight flares.

Fig.3b. EUVI-B 195 Å intensity time-series along the vertical line in Fig. 2h. The prominence trajectory rise with the velocity of 0.83 kms⁻¹ after the sixth eruption (F6). It rises further after the seventh flare (F7), with the velocity of 3.2 kms⁻¹. Finally, prominence erupts after the eighth flare (F8) and material falls back towards the solar surface.

Fig.3c. EUVI-B 195 Å integrated intensity plot of the active region from 16-18 June 2011. F1-F8 shows the position of eight flares.

Discussion and Summary

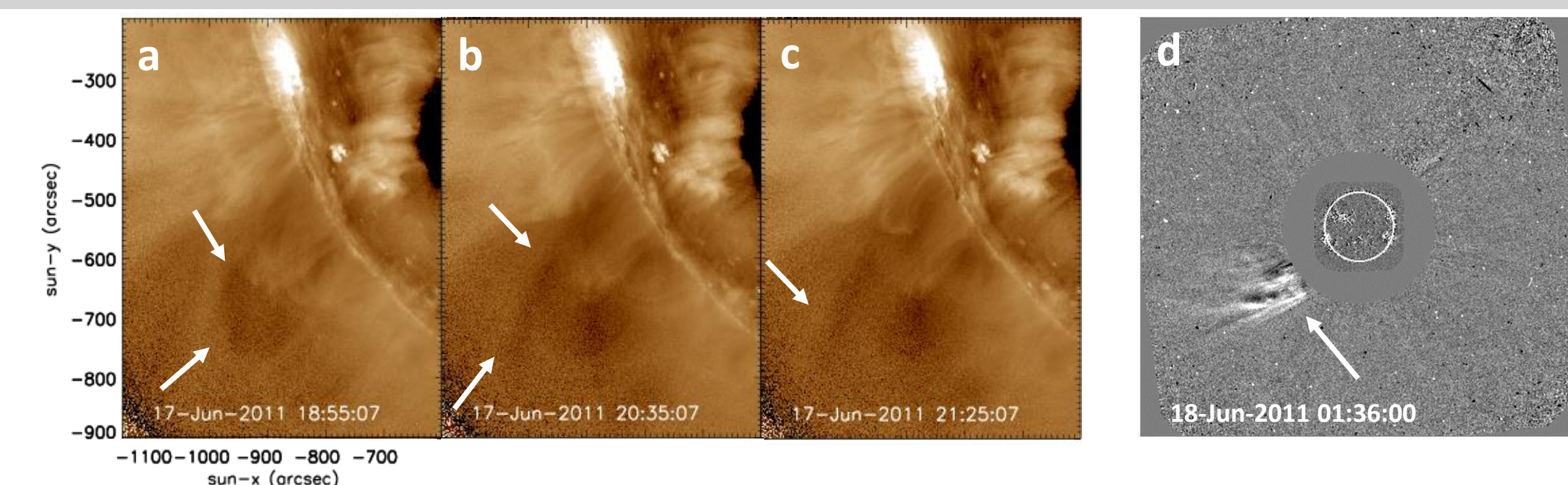


Fig.5. (a-c) AIA 193 Å intensity images showing the expansion of overlying coronal field lines after the prominence eruption. The arrow points towards the expansion of the field lines; d) LASCO (C2) and AIA 193 Å running difference image, an arrow points the CME after the removal of overlying field lines.

- We observed eight homologous flares in 48 hours preceding the CME.
- All the eight flares were associated with confined eruptions and they triggered activity in the nearby prominence/filament system.
- Prominence starts slowly rising after the sixth eruption and it **erupts with the** last two eruptions.
- Consequently the pressure inside the cavity increased resulting in a **non-equilibrium between magnetic tension and pressure forces and it removed overlying field lines**.
- The removal of coronal overlying field lines, results in to the final eruption from the core of the active region, instigating a CME.

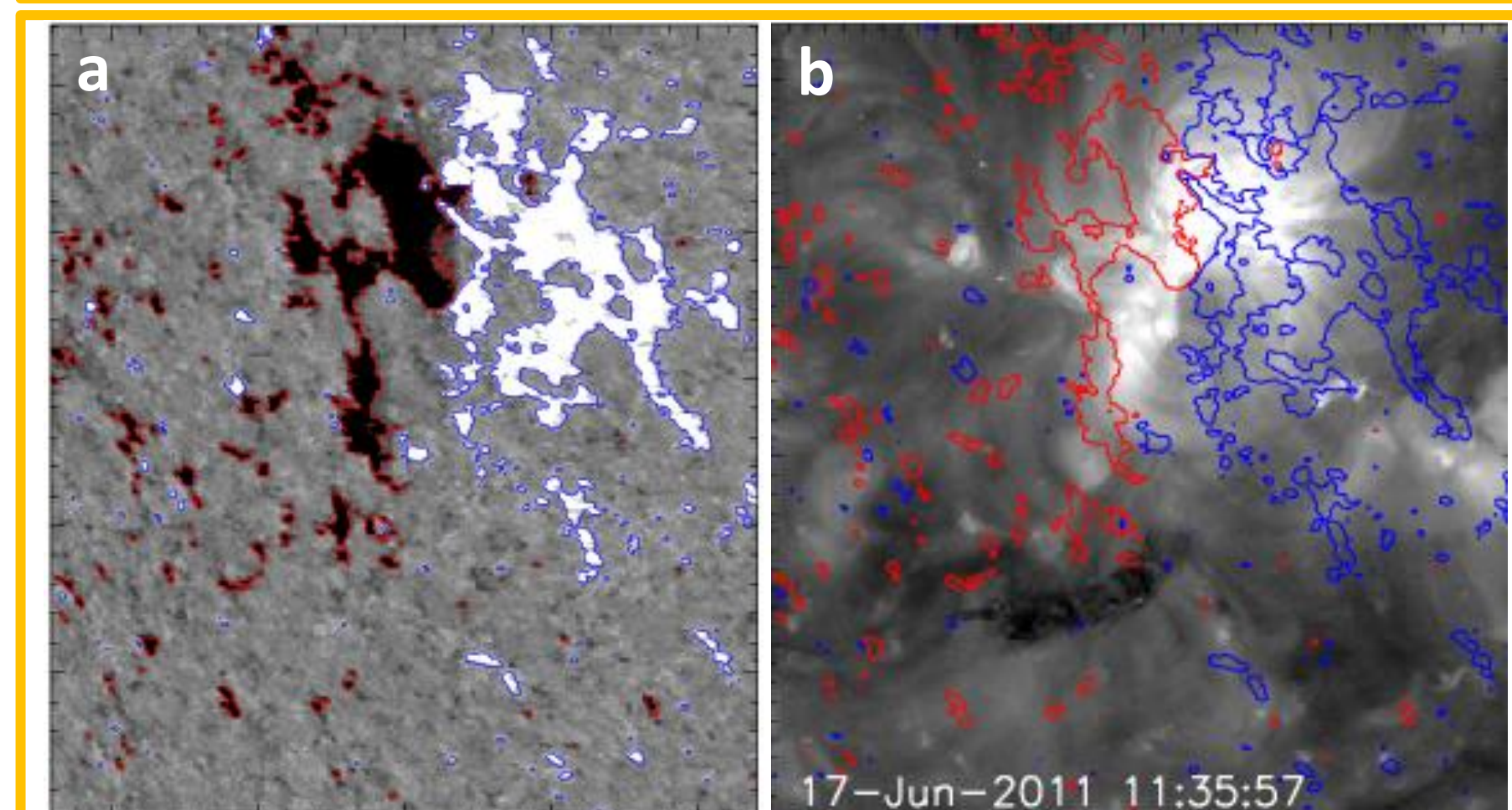


Fig.4. a) HMI magnetogram of the active region observed on 19 June 2011; b) EUVI-B 195 Å image of an active region and prominence, overlaid by the HMI magnetogram of a).

References

Sterling, A.C. et. al 2014, ApJ, 788, L20

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Acknowledgements : SDO, STEREO